# Overview of Radiative Corrections Workshop

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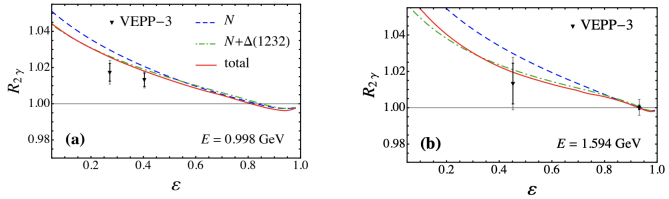
# Our Wish!

- my wish:
  - a versatile, precise, fast generator including all internal and external radiation, energy loss and straggling effects

Figure: J. Friedrich's Talk

# TPE and FF Ratio

- VEPP3 result:




- OLYMPUS result:

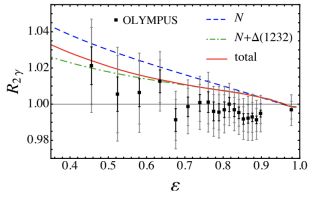





Figure: P. Blunden's Talk. arXiv:2006.12543

# Experimentally

- MUSE has $<1\%$ uncertainties in rad. corr.
- Olympus has new charge average result that eliminates TPE
- MUSE + TPEX will provide new data
- Majority of PRad's uncertainty comes from Møller scattering, which is under development but believed to be under control
  - Developing new generator for elastic e+d scattering based on: I. V. Akushevich and N. M. Shumeiko, J. Phys. G: Nuclear Particle Physics, 20, 513 (1994)
  - Also developing new SIDIS generator
  - Both in C++ :)
- Rad. Corr. contains physics! E.g. searching for X17 in hyperfine transitions: Phys. Rev. A 101, 062503 (2020).

# New EG

- We (IA, Ilyichev, Soroko, Shumeiko, Tolkachev) created the code POLRAD 2.0 that allows to calculations for:
  - RC in DIS on polarized targets of spin of $1/2$ and 1. All contributions including quasielastic radiative tail were implemented.
  - RC to quadruple asymmetry for spin-one targets.
  - RC to semi-inclusive DIS (including polarized targets) in the simple quark-parton model i.e., for the three-dimensional cross section $d\sigma/dxdydz$.
  - Approximate contribution of double bremsstrahlung
  - Electroweak effects
  - The iterative procedure of RC of experimental data

Figure: I. Akushevich's Talk

# MCEG@EIC

**Introduce modern MCEGs to EIC community**

- Integration in EIC simulation software ongoing
- Tutorials:

| | |
|---|---|
| 08/17 | **Pythia 8** Stefan Prestel (LUND) |
| 08/18 | **Rivet** Christian Bierlich (LUND) |
| 08/19 | **Herwig 7** Simon Plätzer (Vienna) |
| 08/20 | **Sherpa** Stefan Hoeche (FNAL) |

**Validation of modern MCEGs with DIS data**

- **HERA** H1, ZEUS, HERMES
- COMAPSS

Figure: M. Diefenthaler's Talk

## Concluding remarks

- NNLO corrections in POLARES, code to be published
- How to correct data?
  Radiative corrections $\otimes$ experimental conditions
  Unfolding
- To Do: Include full mass dependence in $\delta^{(2)}_{\text{2-loop}}$
- To Do: Improve model for 2-photon exchange
  and:
- To Do: Radiation from the proton
  Definition of form factors at NLO



Figure: H. Spiesberger's Talk

# Summary

- Positron as well as electron beams are needed for a complete program of precision physics at EIC
  - QED expansion/radiative corrections
  - Electroweak
  - DVCS
- Technology in hand.
- Not in the initial scope of EIC project, but positron beams are highly desirable.

Figure: R. Milner's Talk

# Final Discussion

General Discussion

# Thank you!

Questions?